

Community Report ‘Atal Ayub Nagar’

Satellite maps and description of the water supply in Atal Ayub Nagar with collated chemical test analysis data and new test results.





**Analysis of chemical contaminants in groundwater
around UCIL plant side in Bhopal**
Satellite maps and description of the water supply in colonies

**Qualitative description of the water supply among communities surrounding the
former Union Carbide India Limited (UCIL) pesticide plant in Bhopal**

Introduction

The Bhopal gas disaster is accepted as the World's worst industrial disaster. Just after midnight, on the night of December 2nd (00:00 3rd December), 1984, a catastrophic gas leak, from the former Union Carbide India Limited (UCIL) pesticide plant, resulted in the release of toxic methyl-isocyanate (MIC) gas. Thousands of residents living in the surrounding communities died immediately due to exposure to the MIC gas.

Twenty-five years after the disaster and there has been no decontamination of the plant site. Toxic chemicals were abandoned there and have been leaching into the soil and groundwater for many years. They are now causing serious health problems, among residents living in the vicinity of the plant, especially through their continued exposure to contaminated drinking water

The purpose of this report is to examine the water supply situation in one, particularly badly hit community, in immediate proximity to the abandoned plant, known as Atal Ayub Nagar. It includes a full survey of the community water supplies, a qualitative description of the water samples, and the collated data from existing laboratory analysis performed by others. It also includes a new set of test results, for one hand pump located within the community, in order to provide an up to date analysis for purposes of comparison. A 'vox pop' survey of residents revealed that some families, living near to this pump, use this water as their regular drinking water supply. Other families walk to other water sources, for their drinking water, but resort to using this supply when those other sources run dry. This is an irregular but frequent occurrence. All the nearby families use this water for other purposes such as washing and cleaning.



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Focus on Atal Ayub Nagar

The community of Atal Ayub Nagar is located in close proximity to the abandoned pesticide plant. Residents build their houses from wood, mud, plastic, cow dung, asbestos and corrugated metal sheets alongside the railway tracks. Residents of this colony cannot afford to build their own private hand pumps or bore wells. A few governmental hand pumps are present, but the water quality of these hand pumps is poor. The other main sources for drinking water are the plastic water tanks located in the community. These are refilled by government tanker trucks.

The water supply in Atal Ayub Nagar is clearly insufficient. The supply from tanker trucks is highly irregular and the plastic water tanks are either broken or badly maintained.

This leaves the water supplied by the governmental hand pumps as the only regular supply of water available to all. Previous chemical analysis showed the presence of several highly toxic chemicals in water samples taken from governmental hand pumps. Our qualitative assessment of the water, and the new test results, prove that it is not fit for drinking.

This is supported by the data taken from studies performed by: Greenpeace (1999); Srishti (2002); and monitoring data from the Madhya Pradesh Pollution Control Board (MPPCB). These all show that groundwater in Atal Ayub Nagar is contaminated with solvents, pesticides and chemicals that were used in the production process of Sevin in the UCIL pesticide plant.

General results

Some residents living in communities surrounding the former UCIL pesticide plant site obtain their drinking water from private hand pumps or bore wells. The boreholes do not typically extend deep into the ground and access only shallow aquifers. Governmental hand pumps, on the other hand, are accessible to everybody and reach a much greater depth. In some communities additional water is provided, by the government, using alternative means. In recent years, plastic or concrete water tanks have been installed, in certain locations, by the municipal corporation. These tanks are refilled either by tanker trucks or by a water pipe system.

The investigated communities show different patterns of water supply. There are communities where almost every household has its own private hand pump and there are other communities depending almost entirely on the water supplied by the government. During the study, several problems were encountered with the water sources, as described below.

Many private hand pumps and bore wells dry out during the summer time when the water table is decreasing. During the monsoon, when the table rises again, the water from these hand pumps is muddy and even with available filtration e.g. through fabric, much particle matter remains in the water. But even with clear water, it is often the case that the water has a metallic taste or smells of solvent. Governmental hand pumps usually provide a continuous water supply throughout the year, but odor problems are also observed from this water supply.

Water supplied by the government in plastic tanks is either extracted from Upper Lake or from a groundwater pumping station. Workers from the municipal corporation reported that the lake water



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undergoes minimum filtration. It is not clear what kind of treatment is applied to the supplied water and whether qualitative monitoring exists. The plastic tanks were originally supplied by tanker trucks but the supplies are not reliable. Residents reported that the water from the tanker trucks is often of poor quality (odor and sediments) and that supply is irregular and insufficient.

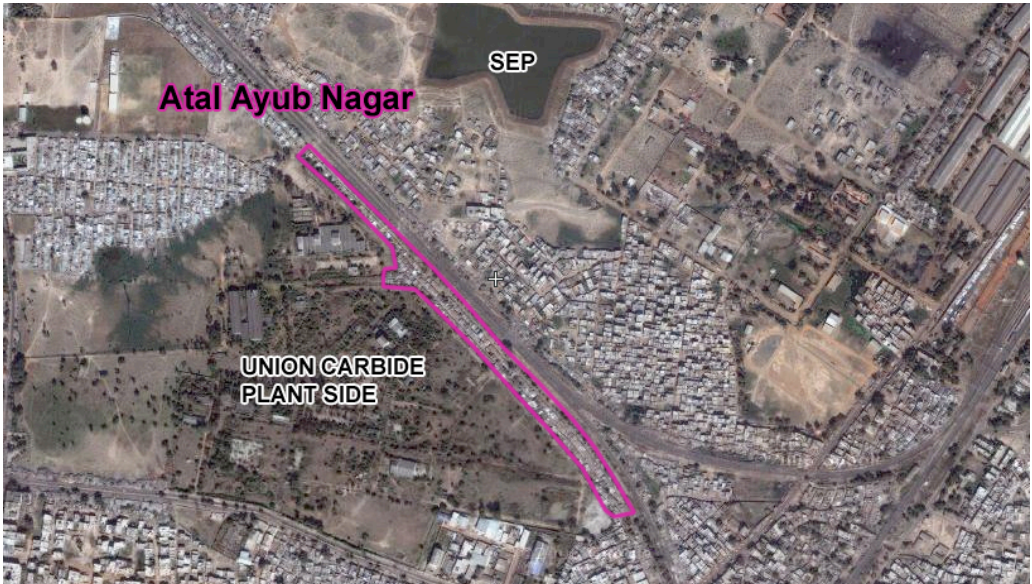

However, the majority of the communities are now hooked up to a rudimentary piping system that delivers water into the tanks. Although the piping system supplies water on a regular basis, compared with the tanker trucks, it is poorly maintained. Pipes lay exposed on the ground and are often ruptured, due to corrosion, allowing inflow of surface and sewage water. The overall situation is that the tanks do not supply enough water, and that the residents resort to the water drawn from the various hand-pumps, even though, in many cases, they know it to be contaminated.

Conclusion

It can safely be said that the water supply in the investigated communities is insufficient and that, due to serious contamination of the groundwater, use of water from both private, and Governmental hand pumps should be avoided. On that basis, thousands of people do not have enough clean water for drinking, washing and cooking.

It is important that the government takes immediate action to improve the maintenance of the water pipe system and the water tanks. Tanker trucks need to provide clean drinking water on a regular basis. The water from the lake or the groundwater pumping station needs to undergo qualitative monitoring and a proper treatment process, if necessary.

I. Summary

<p>Location</p> 	<p>Establishment unknown</p> <p>Inhabitants ~ 1750</p> <p>Area 3.55 ha</p> <p>Location Northeast in the immediate vicinity of UCIL plant side, alongside the railway tracks</p>
<p>Colony Overview</p> 	<p>Legend to Colony Overview</p> <ul style="list-style-type: none"> Colony border Coverage <p>Data Collection Data collection took place on 23.11.07 with Salman Khan as translator and was finished within one day.</p>



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Water Supply

The houses in Atal Ayub Nagar are located next to the railway tracks and are mostly built from wood, plastic, cow dung, asbestos and corrugated metal sheets. Residents of this colony cannot afford to build their own private hand pumps, or bore wells, but a number of government-provided hand pumps are present. The main drinking water sources are plastic water tanks, located throughout the community, which are sporadically refilled by government tanker trucks.

Only three out of the four governmental hand pumps are working. Each hand pump supplies approximately 100 families with water. A qualitative water quality assessment revealed that the water from these hand pumps is not fit for drinking. The water has either a metallic taste, smells of solvents or carries much particle matter. Residents regularly use the water from these hand pumps, for washing and bathing, but it is also used for drinking when there is not enough water supplied by the tanks.

In addition to the hand pumps, one public bore well, installed by the municipal corporation, supplies many families with drinking water. The water from this bore well has a strong metallic taste.

When the residents run out of drinking water, from the tanks, they use water drawn from the governmental hand pumps, even though they consider this water to have a bad taste. Various studies (Greenpeace 1999, Srishti 2002, MPPCB) have shown that groundwater in Atal Ayub Nagar is highly contaminated with a number of chemicals (see section on *Chemicals detected in groundwater*). Water drawn from hand pump H/P AA 2 smelled as if containing significant amounts of solvents, which is in line with the findings of these studies.

In total, ten plastic water tanks are installed in Atal Ayub Nagar, but only six are currently in use. The municipal corporation installed the first four tanks, in 2001. All of these tanks are broken and have not been repaired to date. Six additional tanks were installed between 2003 and 2005. These tanks are operational and are supposed to be refilled daily by government tanker trucks but residents reported that gaps, of up to four days, between refilling are common. The residents also question the quality of the water supplied by these trucks. In addition, the residents did not recall the water tanks ever being cleaned on the inside. This poses a problem, as algal growth in the tanks is likely to occur if fresh water is not introduced on a regular basis. Many residents try to draw water directly from the tanker trucks where the tanks are not refilled regularly, or where the tanks are broken.

It can be said that the water supply in Atal Ayub Nagar is insufficient. Residents depend on being supplied by the tanker trucks for a safe supply of drinking water but the supply is not regular and the plastic water tanks are either broken or badly maintained. The water from governmental hand pumps, which is being drunk in the absence of an alternative supply, is not fit for drinking, as shown by our qualitative assessment of the water, and by previous analytical test reports showing the presence of several chemicals.

Water sources

Table 1: Overview of water sources in Atal Ayub Nagar and the number of sources, from which data has been collected

Water source	Totally mapped	Data collected
Hand pumps	4	4 (100%)
Bore wells	1	1 (100%)
Water tanks	10	10 (100%)
Total water sources	15	15 (100%)

Notes

PICT # 1



This tanker truck is in the northern part of Atal Ayub Nagar, where the water tanks are broken.

PICT # 2



People draw water directly from the tanker truck because the water tanks in this part of the community are broken.



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Chemicals detected in groundwater

The Madhya Pradesh Pollution Control Board (MPPCB), a governmental body, has monitored groundwater in Atal Ayub Nagar for several years. MPPCB tested for several chemicals in irregular time intervals. Greenpeace (1999) investigated toxic contaminants at UCIL and took groundwater samples in Atal Ayub Nagar. Furthermore, Srishti (2002) analysed water samples from seven communities around the Union Carbide India Limited (UCIL) plant site, for several chemicals, with several samples collected in Atal Ayub Nagar.

All studies and sampling campaigns found pesticides and solvents in the groundwater. Data from Srishti, Greenpeace and MPPCB are shown in the following table 2. Chemicals that have exceeded guideline values are highlighted bold.

Table 2: Summary of sampling data collected by Greenpeace (1999), Srishti (2002), and Madhya Pradesh Pollution Control Board (2002-2006)

Chemicals detected in the drinking water of Atal Ayub Nagar community.					
Chemical	Guideline value [ug/L]		Concentration in water [ug/L] ³	Date of sampling	Data source
	WHO ¹	EPA ²			
1,2,3-Trichlorobenzene	20	-	35, 20, 15	1999	Greenpeace
			0.81	03.10.2002	MPPCB
			12.1	07.10.2003	MPPCB
1,2,4-Trichlorobenzene	20	70	145, 25, 15	1999	Greenpeace
1,2-Dichlorobenzene	1000	600	2875, 20, 35	1999	Greenpeace
1,3-Dichlorobenzene	-	-	205, 25, 10	1999	Greenpeace
			19.17	21.11.2005	MPPCB
1,4-Dichlorobenzene	300	75	865, 10, 15	1999	Greenpeace
			405.09	03.10.2002	MPPCB
			73.91	03.10.2002	MPPCB
Carbon Tetrachloride	4	5	3410, 1730, 200	1999	Greenpeace



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Alpha-HCH	-	-	0.14	08.02.2005	MPPCB
Beta-HCH	-	-	1.6	2002	Srishti
			0.04	07.10.2003	MPPCB
Gamma-HCH (Lindane)	2	0.2	1.1	2002	Srishti
			1.8	24.04.2003	MPPCB
			0.01	03.07.2003	MPPCB
			1.74	07.10.2003	MPPCB
					Cont. overleaf
4,4-DDT	1	-	0.36	24.02.2006	MPPCB
			0.02	29.05.2006	MPPCB
Aldrin	0.03	-	0.11	07.10.2003	MPPCB
			0.06	08.02.2005	MPPCB
Dieldrin	0.03	-	0.04	08.02.2005	MPPCB
			0.004	29.05.2006	MPPCB
Endosulphan-I	-	-	0.34	29.05.2006	MPPCB
Endosulphan-II	-	-	0.51	18.02.2003	MPPCB
			0.06	08.02.2005	MPPCB
			0.08	24.02.2006	MPPCB
			0.18	29.05.2006	MPPCB
Chloroform	300	80 ⁴	2590, 100, 160	1999	Greenpeace
			1359.1	2002	Srishti
Chlorobenzene	300	100	56, <5, <5	1999	Greenpeace
Dichloromethane	20	5	106.5	2002	Srishti
Tetrachloroethene	40	5	45, 20, 15	1999	Greenpeace
Hexachloroethane	-	-	85, <5, 15	1999	Greenpeace



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Trichloroethene	20	5	250, <5, <5	1999	Greenpeace
Heptachlor	30	0.4	0.33	29.05.2006	MPPCB
Methoxychlor	20	40	8.6	18.02.2003	MPPCB
Sevin (Carbaryl)	50	-	0.28	29.05.2006	MPPCB

¹ WHO drinking water guidelines according to Guidelines for drinking water quality

http://www.who.int/water_sanitation_health/dwq/gdwq3rev/en/

² All EPA drinking water guideline values can be found at <http://www.epa.gov/safewater/consumer/pdf/mcl.pdf>

³ Greenpeace (1999) took water samples at three sampling sites in Atal Ayub Nagar, the exact position of these sampling sites are not known, all values are given in the same order according to their sampling sites

⁴ As total trihalomethanes (TTHMs)



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Table 3: Test results for Hand Pump Number 1, Atal Ayub Nagar, Bhopal, India. Water sample taken on 06/06/2009.

Chemicals detected in water drawn from 'Hand Pump Number 1', Atal Ayub Nagar.

Water sample taken 06/06/2009. Analysis performed by 'Severn Trent Laboratories, Coventry, United Kingdom.

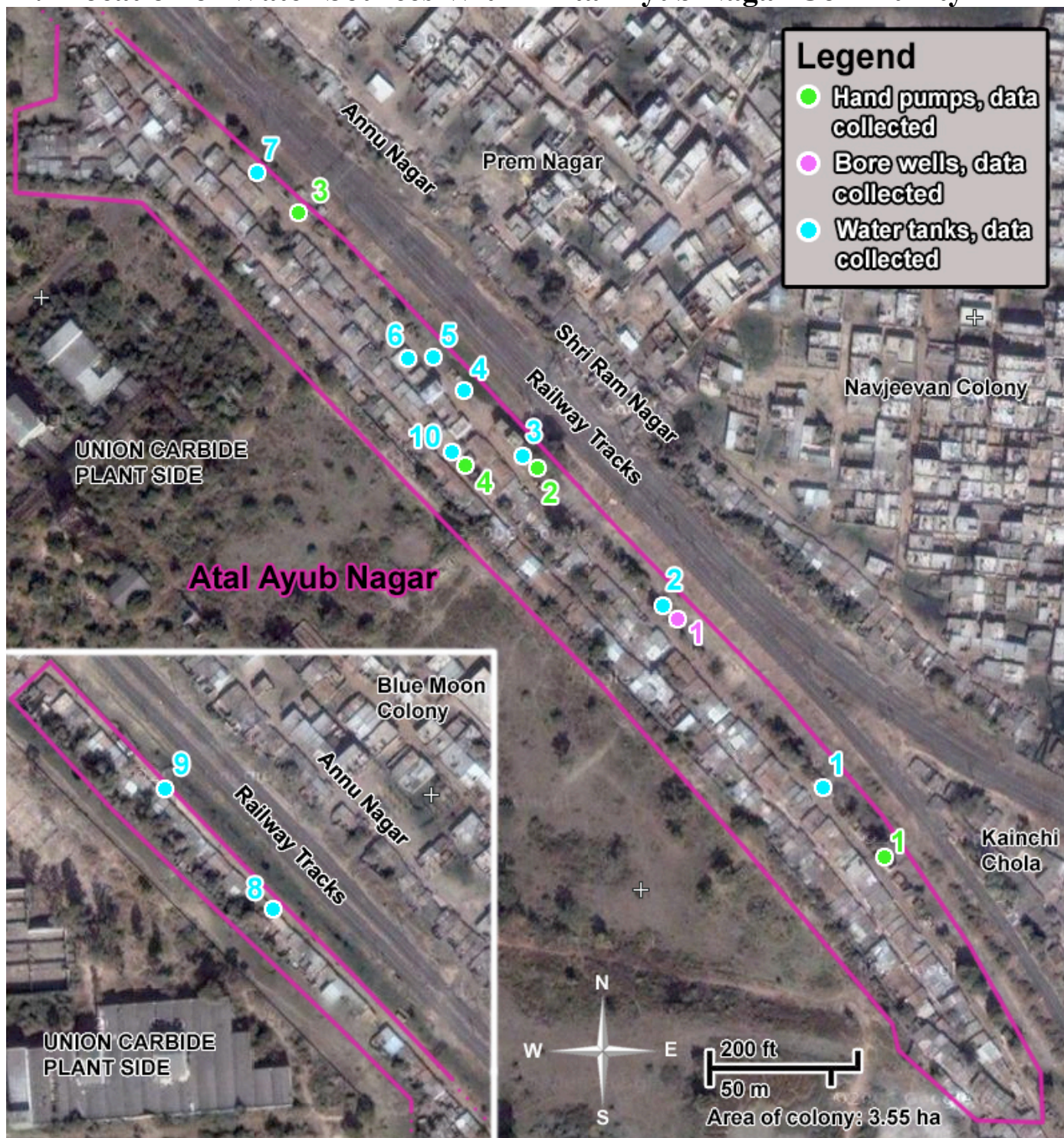
Chemical	Result	Units	Accreditation	Method
Aldrin	<6	ng/l	Y COV	GEO47
Alpha-Endosulphan	<6	ng/l	Y COV	GEO47
Beta-Endosulphan	<6	ng/l	Y COV	GEO47
Dieldrin	<6	ng/l	Y COV	GEO47
Heptachlor Epoxide	<2	ng/l	Y COV	GEO47
o,p – DDT	<2	ng/l	Y COV	GEO47
p,p – DDT	<2	ng/l	Y COV	GEO47
Dichloromethane	<40	ug/l	Y COV	GEO32
Chloroform	<266	ug/l	Y COV	GEO32
Trichloroethane	<40	ug/l	Y COV	GEO32
Carbon Tetrachloride	4880	ug/l	Y COV	GEO32
Tetrachloroethene	<40	ug/l	Y COV	GEO32
Chlorobenzene	<40	ug/l	Y COV	GEO32
Dibromofluoromethane	102.9	%Recovery	N COV	GEO32
Toluene-d8	101.1	%Recovery	N COV	GEO32
4-Bromofluorobenzene	84.1	%Recovery	N COV	GEO32
VOC	Y	ug/l	Y COV	GEO32

Analyst comments: VOC reporting limits raised due to the elevated levels of VOCs present in sample.


Accreditation Codes: Y = UKAS Accredited; N = Not UKAS Accredited; Cov = Analysed at Severn Trent Laboratories Coventry.


This aerial map illustrates the layout of the Bhopal Gas Tragedy site. The Union Carbide plant is located on the left side, with the 'PLANT SIDE' labeled. To the right of the plant are the 'Atal Ayub Nagar' and 'Shri Ram Nagar' colonies, separated by 'Railway Tracks'. Further to the right are the 'Prem Nagar' and 'Navjeevan Colony'. The 'Kainchi Chola' is located on the far right. A scale bar indicates 200 ft and 50 m, and a compass rose shows North (N), South (S), East (E), and West (W). The area of the colony is noted as 3.55 ha.


III. Location of Water Sources Within Atal Ayub Nagar Community





IV. List of water sources


H/P AA 1		
	Installation 1992	Current status Working and in use
	Depth unknown	
	Water quality Metallic taste, particle matter	
	Water availability Continuous supply	
	Estimated # of people using the source ~ 100 families	
	Water used for drinking? Yes	
Additional information Governmental hand pump. For test results from this pump see Table 3.		

H/P AA 2		
	Installation 2005	Current status Working and in use
	Depth unknown	
	Water quality Clear and clean, bad smell	
	Water availability Continuous supply	
	Estimated # of people using the source Many people	
	Water used for drinking? Yes	
	Additional information Governmental hand pump.	

H/P AA 3		
	Installation 1990	Current status Working and in use
	Depth ~ 120 ft	
	Water quality Poor quality, metallic taste	
	Water availability Continuous supply	
	Estimated # of people using the source ~ 150 families	
	Water used for drinking? Yes	
	Additional information Governmental hand pump.	


H/P AA 4		
	Installation unknown	Current status Not working
	Depth unknown	
	Water quality Poor quality	
	Water availability unknown	
	Estimated # of people using the source unknown	
	Water used for drinking? unknown	
Additional information Governmental hand pump. The hand pump was closed down by the municipal corporation in 2003, the reason is not known.		

B/W AA 1		
	Installation 2006	Current status Working and in use
	Depth unknown	
	Water quality Metallic taste	
	Water availability Continuous supply	
	Estimated # of people using the source Many people	
	Water used for drinking? Yes	
Additional information Public mechanical bore well. Bore well was installed by the municipal corporation.		

W/T AA 1		
	Installation 2005	Current status Working and in use
	Depth N/A	
	Water quality Clean and clear, no detectable smell	
	Water availability Scheduled daily refill. Refilled sporadically.	
	Estimated # of people using the source ~ 50 families	
	Water used for drinking? Yes	
	Additional information Plastic tank. Refilled by tanker truck with filtered water from Upper lake.	

W/T AA 2		
No picture available	Installation 2004	Current status Working and in use
	Depth N/A	
	Water quality Clean and clear, no detectable smell	
	Water availability Scheduled daily refill. Refilled sporadically.	
	Estimated # of people using the source unknown	
	Water used for drinking? Yes	
Additional information Plastic tank. Refilled by tanker truck with filtered water from Upper lake.		

W/T AA 3		
No picture available	Installation 2004	Current status Not working
	Depth N/A	
	Water quality unknown	
	Water availability Scheduled daily refill. Refilled sporadically.	
	Estimated # of people using the source unknown	
	Water used for drinking? unknown	
Additional information Plastic tank. Refilled by tanker truck with filtered water from Upper lake. The tank is broken since 2006 and has not yet been repaired by the municipal corporation, although people demanded to do so.		

W/T AA 4		
	Installation 2004	Current status Working and in use
	Depth N/A	
	Water quality unknown	
	Water availability Scheduled daily refill. Refilled sporadically.	
	Estimated # of people using the source Many people	
	Water used for drinking? Yes	
Additional information Plastic tank. Refilled by tanker truck with filtered water from Upper lake. The tank is broken since 2006 and has not yet been repaired by the municipal corporation, despite resident's demands that they do so.		



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W/T AA 5		
No picture available	Installation 2004	Current status Not working
	Depth N/A	
	Water quality unknown	
	Water availability unknown	
	Estimated # of people using the source unknown	
	Water used for drinking? unknown	
Additional information Plastic tank. Refilled by tanker truck with filtered water from Upper lake. The tank is broken and has not yet been repaired.		

W/T AA 6		
No picture available	Installation 2004	Current status Working and in use
	Depth N/A	
	Water quality unknown	
	Water availability Scheduled daily refill. Refilled sporadically.	
	Estimated # of people using the source Many people	
	Water used for drinking? Yes	
Additional information Plastic tank. Refilled by tanker truck with filtered water from Upper lake. The tank is broken and has not yet been repaired.		



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W/T AA 7		
No picture available	Installation 2004	Current status Working and in use
	Depth N/A	
	Water quality unknown	
	Water availability Scheduled daily refill. Refilled sporadically.	
	Estimated # of people using the source Many people	
	Water used for drinking? Yes	
Additional information Plastic tank. Refilled by tanker truck with filtered water from Upper lake. People report that the tank often is just half refilled.		


W/T AA 8		
No picture available	Installation 2004	Current status Working and in use
	Depth N/A	
	Water quality unknown	
	Water availability Scheduled daily refill. Refilled sporadically.	
	Estimated # of people using the source Many people	
	Water used for drinking? Yes	
Additional information Plastic tank. Refilled by tanker truck with filtered water from Upper lake. People report that the tank often is just half refilled.		



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W/T AA 9		
No picture available	Installation 2004	Current status Not working
	Depth N/A	
	Water quality unknown	
	Water availability Refilled every 3-4 days	
	Estimated # of people using the source Many people	
	Water used for drinking? Yes	
Additional information Plastic tank. Tank broke after six month in use and has not been repaired yet. Supplied by tanker truck, water source unknown.		

W/T AA 9		
No picture available	Installation 2004	Current status Not working
	Depth N/A	
	Water quality unknown	
	Water availability Refilled every 3-4 days	
	Estimated # of people using the source Many people	
	Water used for drinking? Yes	
Additional information Plastic tank. Tank broke after six month in use and has not been repaired yet. Supplied by tanker truck, water source unknown.		

W/T AA 10		
	Installation	Current status
	2003	Working and in use
	Depth	
	N/A	
	Water quality	
	Sometimes bad quality	
	Water availability	
	Scheduled daily refill. Refilled sporadically.	
	Estimated # of people using the source	
	Many people	
	Water used for drinking?	
	Yes	
Additional information Plastic tank. Refilled by tanker truck with filtered water from Upper lake.		